

*American Railway
Master Mechanics' Association*

BEST PROPORTION OF FLUE AND GRATE AREA
IN LOCOMOTIVES.

The following questions refer to boilers using bituminous coal.

1. Have you, in renewing boiler tube plates, or in building a series of new boilers, altered the number or size of flues, or altered the clearance space between them, without altering the length of flue or altering any other part of the boiler or engine?

If so, can you give comparative results, either in fuel consumed for work done or in water evaporated, stating the exact change or variation you made which produced such results? This information should be given in answering any of the questions; and in quoting results, endeavor to distinguish between higher evaporative power ("free steaming") and increased economy in evaporation (more water boiled off per lb. of fuel).

2. Have you made any such change keeping the flue-heating surface the same in total amount, but putting in flues of larger diameter, so as to increase the gas opening through the flues; or made any such change, still keeping the flue-heating surface the same, but putting in flues of smaller diameter, thus decreasing the gas opening through the flues?

3. Have you made any such changes, either shortening or lengthening the flues, but keeping the total flue-heating surface the same?

4. Do you know of any instance in which reducing the flue-heating surface, or reducing the gas opening through the flues, increased in any way the efficiency of the boiler?

5. Have you made any changes in the amount of grate surface without altering the boiler or engine at any other point? If so, with what result? If you have knowledge of any experiments of this kind carried out on other than locomotive boilers, kindly quote them also.

6. In designing or ordering locomotives, do you proportion the amount of grate surface simply to suit the quality of coal likely to be used, or do you believe—if the boiler is to be in its most effective condition—that the grate surface should bear some definite proportion to the flue-heating surface, or to the gas opening through the flues? If you proportion, give the ratios you use or would like to use.

7. Is it possible, within the narrow limits of deviation allowed in an ordinary locomotive, to give a boiler too large a grate surface?

A grate may be too long for the fireman to equally cover it with coal, or it may have too much air opening through it to suit certain qualities of fuel; but these points are not properly to be taken into a consideration of the question of absolute grate surface.

8. If to use a certain quality of fuel you have found it necessary to put at one end of the grate a solid "dead plate" or "drop plate," has such reduction of the effective grate area lessened the evaporative power or the economical efficiency of the boiler? In answering question 8, a note should be made as to whether, in making the change, the clearance between the firebars (air space) was altered.

9. Have you in any way improved a boiler by reducing the total grate surface, all other points remaining unchanged?

10. Are you familiar with any experiments tending to show that rapid combustion is, for steam purposes, more economical than slow combustion? If so, quote or refer to them, and say if you think the result is due to the higher temperature (commonly believed to accompany rapid combustion) transmitting a larger portion of its heat through the metal or to a more thorough burning of the fuel?

This matter has a close bearing on the whole subject, for, other things being equal, the smaller the grate the more rapid is the combustion.

11. What is the present limit, in locomotive practice, to the number of lbs. of good clean coal that can be fully burnt per hour per square foot of grate surface?

12. Are there any facts from which it may be reasonably inferred that this limit will in the near future be exceeded?

13. How many lbs. of water (from and at 212°) will one lb. of good coal evaporate when the grate is thus working up to its highest limit?

14. What is the minimum amount of flue surface per square foot of grate that will do this high duty?

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